Shri Mata Vaishno Devi University, Katra
School of Electronics & Communication Engineering
B. Tech. (ECE), Major Examination, Odd Semester, 2018-19

Entry No: _____ 17 BEC0 33 _____

Date: 28/09/2019

Embedded Systems & Microcontrollers (ECL 3080)

Time Allowed: 1.5 Hours

Max Marks: [30]

i. **Attempt All Questions. ii. Make Assumptions as needed**

Q1. a) Why is isolation required between circuits and how can optocouplers be used to achieve isolation in circuits? [3]

b) Write a function in embedded C to generate a delay of 20mS using Timer 0 of 8051 µC. [3]

Q2. a) Interface a 8KB ROM and two 2KB RAM ICs to a 8051 µ-controller. The starting address for ROM needs to be 0000H while the starting address for RAM is 4000H. [5]

b) What are the important pins in a typical 20 x 2 Dot Matrix LCD display module? Write the code in Embedded C to configure the display module and display the message "Good Morning, This is a Test Message for the display" for 2 seconds after which the message should change to "Additional Testing of display". [5]

c) Write a function in Embedded C which accepts one byte data as argument and converts the same into three digit BCD equivalent number and stores the three digits, after converting into ASCII, in memory locations named loc1, loc2 & loc3. E.g. if input is 0x2A then it converts this into three digit BCD 0x00, 0x04, 0x02 and then ASCII 0x30, 0x34 & 0x32. [5]

Q3. Two 8051 µ-controllers A & B are connected to each other using the serial Port i.e. Tx of A is connected to Rx of B. Two keys named UP and DOWN are connected to INT0 and INT1 interrupts of the 8051 µ-controllers A. In 8051 µ-controllers A, a variable called _counter_ is initialized to 0x00 at start-up and is incremented by 2 every time the UP key is pressed or is decremented by 1 every time key DOWN is pressed. The value of the variable counter is transmitted over the serial port by 8051 µ-controllers A repeatedly to 8051 µ-controllers B which receives the byte over the serial port line and stores it at memory location 0x3000. Draw the circuit showing the connections and write the separate code in Embedded C for the two 8051 µ-controllers A & B accordingly. Assume X'tal of 11.0592 MHZ in both and Serial communication at 9600 baud with one start and one stop bit. [9]

Course Outcomes

After Successful Completion of this Course, students shall be able to;

CO No.	Course Outcome	Question Number
CO1	Understand the architecture of 8-bit/16-bit Microcontrollers & related peripherals	Q2(b)
CO2	Understand and implement principles of Embedded Design	
CO3	Do Hardware Interface Design using 8-bit and 16-bit Microcontrollers	Q1(a), Q2(a), Q(3)
CO4	Write code in Assembly language or Embedded C for 8-bit and 16-bit Microcontroller	Q1(b), Q2(b-c), Q(3)

Shri Mata Vaishno Devi University, Katra
School of Electronics & Communication Engineering
B. Tech. (ECE), Major Examination, Odd Semester, 2019-20

Entry No: 17BEC033

Date: 16/12/2019

Embedded Systems & Microcontrollers (ECL 3080)

Time Allowed: 3.0 Hours

Max Marks: [50]

i. **Attempt All Questions. ii. Make Assumptions as needed**

Q1. a) I^2C Protocol uses _____ number of signals for implementation. [1]

b) CISC stands for _____ while RISC stands for _____. [2]

c) FPGA is a correct example of Embedded System. TRUE or FALSE. [1]

d) What is use of XGATE Co-processor in S12X microcontroller? [1]

Q2. a) Write code in Embedded C to generate a square wave of frequency 500Hz on Port Line 0.2 using Timer 0. Mention any special factor to keep in mind, if any. Assume crystal frequency of 12MHz. [3]

b) Write code in embedded C to transfer the first 10 even numbers stored from memory location 2000H to memory location 4000H, assuming that a total of 50 numbers are stored from 2000H onwards. [3]

c) Briefly mention the characteristics of an Embedded System. [3]

Q3. a) What is Output Compare feature in S12X Capture Compare Timer? Write algorithm (steps) to show how this feature can be utilized for generating a square wave on the Timer Output Pin. [2+3=5]

b) Write a function named **flexdelay** in Embedded C which can be used to generate a delay in multiples of 100 μsec depending upon the value of integer value of delay passed as an argument to it e.g. **flexdelay(300)** means delay of 300 μsec. The function should use the Timer 1 of 8051 μ-controller. Show calculations. Crystal frequency=12MHz. [5]

c) Write briefly about the Voltage Regulator Unit in S12X micro-controller with diagram. [3]

Q4. a) Design the following interface application using S12X μ-controller:

i. Draw circuit diagram showing interface of two Keys (K1 & K2) and 4 LEDs (L1, L2, L3 & L4) to Port lines of Port B of S12X μ-controller. [2]

Write code for above circuit such that the LEDs are turned ON as below: [3]

i) If no key pressed, all LEDs ON ii) If both K1 & K2 pressed then all LEDs OFF

iii) If only K1 Pressed then -L1,L2- ON, L3,L4 OFF

iv) If only K2 Pressed then -L1,L3- ON, L2,L4 OFF

b) An embedded system unit, located in a mine shaft, sends information regarding the %age of carbon monoxide in the mine, using its serial port @9600 baud, 1Start & Stop Bit, in the following string format :SHAFT.1 CO% 00.3:, repeatedly. The ":"is an indicator of start and end of each string transmitted. Write the code in Embedded C for 8051 μ-controller for the

Receiving Unit located in the main office where the serial data is received, to store the received strings starting from memory location 3500H in this unit. Write program such that only the **first three full strings** are stored and then serial communication of Receiving Unit is stopped. Assume Crystal frequency: 11.0592MHz. **[5 Marks]**

c) Write briefly about the Clock & Reset Generator Block of S12X with diagram. Indicate clearly the possible sources of Reset generation in the S12X μ-controller. **[5]**

Q5. a) A room heater can be switched ON or OFF by an 8051 microcontroller using a relay. An ADC0809 is also interfaced to the 8051 μ-Controller. A temperature sensor measuring 0-50°C generates an analog voltage of 0-5V depending upon the temperature measured. This analog voltage is connected to IN0 analog input channel of ADC 0809.

i. Draw the circuit diagram of the arrangement described above. **(2 Marks)**

ii. Write the software in embedded 'C' or Assembly language to read the temperature value from the ADC and turn ON the room heater if temperature is below 15°C and turn it OFF if temperature is above 25°C. **(3 Marks)**

b) Draw and briefly explain the Port Structure of any Port of 8051 μ-controller. **[3]**

Course Outcomes

After Successful Completion of this Course, students shall be able to;

CO No.	Course Outcome	Question Number
CO1	Understand the architecture of 8-bit/16-bit Microcontrollers & related peripherals	Q1(d), Q3(a,c), Q4(c), Q5(b)
CO2	Understand and implement principles of Embedded Design	Q1 (a,b,c), Q2(c)
CO3	Do Hardware Interface Design using 8-bit and 16-bit Microcontrollers	Q4(a), Q5(a)
CO4	Write code in Assembly language or Embedded C for 8-bit and 16-bit Microcontroller	Q2(a,b), Q3(b), Q4(a,b), Q5(a)